S
616.9223
H2RMSF
1923

HISTORICAL SOCIETY
OF MONTANA
HELENA

BULLETIN

OF THE

Montana State Board of Health

HELENA, MONTANA

SPECIAL BULLETIN NO. 26 JUNE, 1923

ROCKY MOUNTAIN SPOTTED FEVER

Conference of Health Officials of the Rocky Mountain States and Provinces

Held at

MISSOULA, MONTANA

April 5th and 6th, 1923

Entered as second-class matter July 10, 1914, at the Post Office at Helena, Montana, under the Act of August 24, 1912.

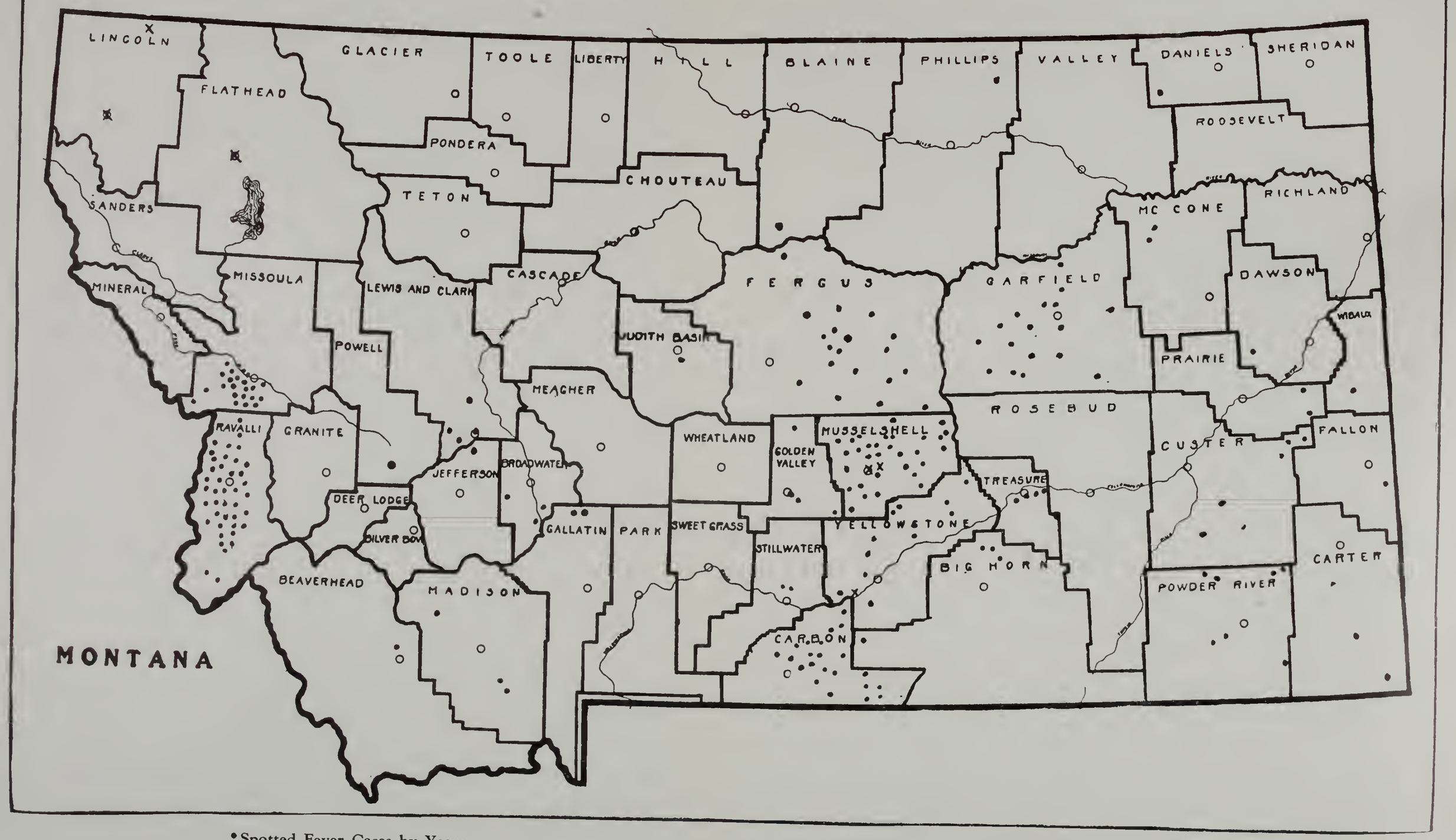
This Bulletin will be mailed to any person in Montana on request to the Secretary of the State Board of Health at Helena.

Montana State Library
3 0864 1006 0621 2

Digitized by the Internet Archive
in 2014

http://archive.org/details/rockymountainspo1923unse

Rocky Mountain Spotted Fever and Tick Paralysis in Montana 1914 - 1922



•Spotted Fever Cases by Years

1914	16 Cases
1915	43 Cases
1916	21 Cases
1917	25 Cases
1918	10 Cases
1919	14 Cases
1920	25 Cases
1921	25 Cases
1922	57 Cases

×Tick Paralysis Cases by Years

1914	0 Cases Reported
1915	0 Cases Reported
1916	0 Cases Reported
1917	0 Cases Reported
1918	2 Cases
1919	1 Case
1920	2 Cases
1921	1 Case
1922	0 Cases

CONTENTS

Page

Foreword 3

Diagnosis of Rocky Mountain Spotted Fever, F. D. Pease, M. D. 5

The Spotted Fever Tick, R. A. Cooley 9

The Prevalency and Distribution of Rocky Mountain Spotted Fever in Oregon, F. D. Stricker, M. D. 18

Rocky Mountain Tick Fever in the State of Washington, A. U. Simpson, M. D. 20

Incidence of Rocky Mountain Spotted Fever in Wyoming, A. B. Tonkin, M. D. 23

Incidence of Rocky Mountain Spotted Fever in Idaho, R. R. Parker 27

Control Methods in the Repression of Spotted Fever, W. J. Butler, D. V. S. 28

Maintenance of the Virus of Spotted Fever in Nature With Particular Reference to Conditions in the Bitter Root Valley, R. R. Parker 33

Experimental Studies of the Virus of Rocky Mountain Spotted Fever, R. R. Spencer, M. D. 40

Prophylactic Inoculation Against Rocky Mountain Spotted Fever, H. Noguchi, M. D. 44

Tick Paralysis, W. F. Cogswell, M. D. 47

Resolutions Passed by the Conference 49

UNIVERSITY AUDITORIUMS USED.

Through the courtesy of officials of the University of Montana, the Missoula meetings of the conference were held in campus auditoriums.

The final sessions were held in the United States Public Health Service laboratory at Hamilton, which is the headquarters for investigational work of the disease in Montana. Dr. Spencer, who is in charge of the laboratory gave the experts practical laboratory demonstrations of the work which is under way there.

The visitors appeared to be greatly interested in the laboratory, and spent considerable time in their inspection of it.

FOREWORD

The Secretary of the State Board of Health of Montana issued a call to the state and provincial health officers of the Rocky Mountain district, March 7th of the current year, to meet in Missoula to consider the Rocky Mountain spotted fever problem. The reasons for issuing the call were, first,—to take stock of the number of cases occurring in each of the states and provinces; second,—to consider methods of control, and third,—to demonstrate in a practical way that the Rocky Mountain spotted fever problem was not a local one but was one common to the Rocky Mountain district.

The conference was held in Missoula April 5th and 6th. Invitations were extended the representatives of the U. S. Public Health Service, Dr. Hideyo Noguchi of the Rockefeller Institute, and Dr. S. B. Wolbach of Harvard University, men who have been making a study of the different phases of the problem extending over a number of years. A general invitation was also extended to the medical profession of Montana to attend, and a number availed themselves of the opportunity. The State of Wyoming was represented by Dr. Albert B. Tonkin, state health officer; the State of Oregon by Dr. Frederick D. Stricker, state health officer; and the State of Washington by Dr. A. U. Simpson, state epidemiologist. The U. S. Public Health Service was represented by Dr. R. R. Spencer, who is in control of the investigational work in the Bitter Root Valley, Montana, and Dr. R. R. Parker, scientific expert of the U. S. Public Health Service, who is working with Dr. Spencer. The Rockefeller Institute was represented by Dr. Noguchi, and the State Board of Entomology was represented by Dr. W. J. Butler, state veterinary surgeon, and Prof. R. A. Cooley, state entomologist. Dr. F. D. Pease, full-time health officer of Missoula, and Prof. J. X. Newman of the biology department of the State University of Montana were also present and took part in the discussion. Letters were received from other state health officers of the Rocky Mountain district, in which they expressed their

sympathy with the work and regrets that they could not attend the conference. Most of the reasons given for not attending were that the legislatures were in session and it was difficult for them to get away. However, reports were sent relative to the incidence of the disease in their states and provinces.

The conference was called to order by Dr. W. F. Cogswell, Secretary of the Montana State Board of Health. In calling the conference to order, he stated the reasons for the meeting as given above. We give in this, a special bulletin, the papers read at the sessions.

The outstanding features of the conference were the announcements by Dr. Spencer of a practical method of determining whether or not a tick was infected, and the announcement by Dr. Noguchi of the Rockefeller Institute, of the discovery of a prophylactic serum. Dr. Noguchi remained in Montana about a week and while there inoculated nine Japanese and all of the laboratory force at Hamilton with the serum. This was given in two doses, one week apart, and in none of the cases was there any unpleasant reaction. Preparations are being made by the Montana State Board of Health, in cooperation with the Rockefeller Institute, to manufacture this serum in the hygienic laboratory at Helena. If the serum is found by experience to be effective, the discovery will no doubt revolutionize control work in Montana. Since the conference, over 150 people in the Bitter Root Valley have voluntarily taken the serum, which has been prepared in the laboratories of the Rockefeller Institute, New York, and furnished free of charge. The administration of the serum by Dr. R. R. Spencer of the U. S. Public Health Service has also been free of charge.

We feel that this conference marks an epoch in the investigational work of Rocky Mountain spotted fever, and have decided to publish in a special bulletin the work of the meeting. We invite your special consideration to papers read by the various experts who were in attendance.

DIAGNOSIS OF ROCKY MOUNTAIN SPOTTED FEVER.

By

F. D. PEASE, M. D.
City and County Health Officer,
Missoula, Montana.

Maxey defined "Rocky Mountain spotted fever" as an acute endemic, non-contagious but probably infectious disease, characterized clinically by a continuous moderately high fever, severe arthritic and muscular pains, and a profuse petechial eruption in the skin, appearing first on the ankles, wrists and forehead, spreading rapidly to all parts of the body.

Wolbach, in view of our knowledge of the etiology and pathology, defined the disease as "an acute specific endangeitis, chiefly of the peripheral blood vessels, transmitted by a tick Dermacentor venustus, and characterized by onset with chill, continued fever, severe pains in bones and muscles, headache, and a macular eruption becoming petechial, which appears first on wrists, ankles and back, then over the whole surface of the body."

Owing to the opposition to the tick theory by some, and to numerous tick bites on others of those suffering from tick fever, considerable difficulty has been experienced in arriving at a correct period of incubaton. McCalla's experiment upon two men gives an incubation period in one as three, and in the other nine days. Various observers, basing their opinion upon a small number of cases, give the incubation period from three to twelve days.

The onset of Rocky Mountain tick fever is similar to numerous other infectious diseases. It may be sudden with a distinct chill, severe headache, dizziness, vomiting, epistaxis, intense pains referred to the bones and muscles, especially in the lumbar region. The conjunctivae become injected and the face flushed. The tongue becomes coated with a white fur and a red tip. There is often a slight cough without sputum. In the severer cases delirum makes its appearance early.

In the milder types of the disease the onset is less abrupt. There may be chilly sensations, malaise, slight headache and a moderate elevation of temperature.

Temperature.

In the milder cases there is a gradual rise of temperature similar to that of typhoid fever until it reaches its maximum of 103° or 104° at the beginning of the second week. In the severer types of the disease, ushered in with a distinct chill, the temperature reaches 104° or 105° on the second or third day. During the second week the temperature is continuous with a slight morning drop. In those cases in which recovery takes place the temperature falls by lysis, usually reaching normal by the end of the third week. In fatal cases the temperature remains high, though in some the temperature falls to normal followed by a sudden rise just before death.

Eruption.

The eruption, which is the deciding factor in the diagnosis, makes its appearance from the third to the seventh day. It shows first on the wrists and ankles, spreading rapidly over the body, the abdomen being the last part affected and where it shows the least. In character the rash consists of rose colored unelevated macules from two to four mm. in diameter. At first the eruption disappears upon pressure, but soon becomes petechial and permanent as well as confluent. McCullough speaks of the fully developed eruption as having the appearance of a turkey egg. Frequently subcutaneous hemorrhages varying in size, make their appearance. As the disease advances, the skin upon the back and thighs becomes dark red or bluish in color, due to stasis.

With the subsidence of the fever the rash gradually fades, followed by desquamation. Occasionally casts of the hands and feet similar to scarlet fever are seen. Cases of necrosis of the skin have been reported. The parts most frequently affected are the scrotum, prepuce, fingers, toes and ears. In addition to the eruption the skin is always jaundiced. This is first noticed in the conjunctivae. As there is no evidence of bile in the urine or an absence of bile in the intestinal tract, the jaundice should be classified as nonobstructive or toxemic.

Gastro-intestinal symptoms.

The tongue becomes covered with a white fur with red edges and tip. As delirium or coma comes on, the tongue and lips become dry, fissured and covered with sordes, similar to other febrile diseases. Vomiting may occur during the first week. Later on in the disease the vomited material may contain blood. Anorexia is present, although not marked during the first week. Constipation is the rule.

Pulse and respiration.

During the first few days of the illness the pulse is full and strong, with only a moderate increased rate. In severe or fatal cases the pulse soon reaches 140 to 150. The systolic blood pressure gradually drops, and the first sound of the heart becomes muffled and indistinct.

The respirations increase in proportion to the pulse and temperature. In cases where pneumonia or hypostatic congestion supervene, the rate reaches 50 to 60 per minute. The lungs are negative unless complicated with pneumonia, when the usual signs of that condition will be found.

Nervous symptoms.

In severe cases delirium and restlessness are early symptoms. The delirium may be active or of the low muttering type similar to typhoid fever. Coma in fatal cases comes on shortly before death, hyperesthesia of the skin and marked stiffness has been reported about the muscles of the neck and back, very much resembling that of cerebro-spinal meningitis. Convulsions have been observed in children, and in a few adults just prior to death.

Urinary symptoms.

There is considerable variation in the reports upon the examination of the urine. Maxey states that he never found albumin present. In cases coming from the Bitter Root region, albumin, blood, granular, hyaline and epithelial casts are usually present. The pathology of the kidneys, both gross and microscopic would not warrant a negative report upon the urine. The amount of urine is of considerable prognostic value. There is always a lessened amount. If the output of urine only reaches from one-third to one-half of the normal, the case is almost sure to ter-

minate fatally. Whether the lessened secretion of urine is due to changes in the kidneys or to a failing circulation, has not been definitely settled.

Blood changes.

Anderson, Wolbach, Parsons, and Michie each report blood examinations in two cases. The examinations began a number of days after the onset and are too few in number to come to reliable conclusions as to the blood changes. The examinations of the blood showed a white count of from 8,000 to 12,000. A moderate decrease in the erythrocytes and hemoglobin, and a prolongation of the coagulation time was shown. The differential count gave a decrease in some of the cases of the neutrophiles and an increase in the endothelials. The increase in the endothelial cells was the only constant change and may prove to be of some value in differential diagnosis.

Differential diagnosis.

In common with the other infectious eruptive diseases it is not possible to make a positive diagnosis before the appearance of the rash. Before the appearance of the eruption, the severe headache, pain in the bones, muscles and back, might confuse the disease with influenza or smallpox.

In mild cases of tick fever with a delayed or possible absence of the eruption, the disease may simulate typhoid fever. A positive blood culture or Widal would clear up the diagnosis.

In the early days in the Bitter Root Valley, the disease was thought to be a severe type of measles, or black measles. No difficulty should be experienced in separating the two conditions by one who has seen a case of tick fever.

In localities where typhus and tick fever might coexist there would be great difficulty in differentiating between the two conditions. The period of incubation, mode of onset, eruption, course of the disease, termination and increase in the endothelial cells are very similar in both. The two diseases differ from each other in the leukocyte count and location of the rash when it first makes its appearance.

In cases where active delirium, hyperesthesia and stiffness of the muscles of the neck are prominent symptoms,

difficulty may be experienced in differentiating it from cerebro-spinal meningitis, but in the latter disease there would be a marked leukocytosis and a cloudy spinal fluid.

In going over the literature and case histories of tick fever, I have not been able to obtain any data as to the length of residence in the localities where the infection took place. In the Lo Lo and O'Brien canyons, the two infected districts in Missoula County, I am of the opinion that the newcomer is much more subject to infection than those who have lived in the localities for some time. If this condition is true throughout the Bitter Root region, then it raises the question as to whether or not some of the old settlers have had at some time a very mild and unrecognized type of the disease which has rendered them immune.

THE SPOTTED FEVER TICK.

Dermacenter venustus Banks.

By

R. A. COOLEY, Entomologist,
Montana State College,
Bozeman, Montana.

The spotted fever tick has been a very common species in the Northwest for many years, and was formerly called the "wood tick". Wilson and Chowning in 1903 first suggested that it might be the means by which man became infected with Rocky Mountain spotted fever. Dr. H. T. Ricketts, working under the auspices of the Montana State Board of Health, showed by experimental work in 1906 that it is in fact the transmitter of this disease. Since that time the species has been called the spotted fever tick in common use.

Reasons Why This Tick is Important.

We are interested in this tick for the following reasons:

1. It is the means, and the only means, of man's infection with Rocky Mountain spotted fever. Laboratory workers may become infected with the virus through abrasions in the skin; but in a state of nature there is no other way in which man becomes infected.

2. Both man and domestic animals are subjected to

a form of paralysis called "Tick Paralysis", which is caused by this species. This disease is becoming fairly common in the northwestern states and in British Columbia.

3. Wholly aside from the two distinct diseases mentioned above its bite frequently causes septic ulcers which sometimes are of long standing and stubborn.

4. It is an annoying parasite of man, causing apprehension and discomfort to many persons who love the open air and delight in tramping.

5. It is a parasite of domestic animals of considerable importance, commonly attacking horses, cattle, and sheep.

Other Species of Ticks in Montana.

Besides the spotted fever tick there are eight other species, which are present in the state of Montana in more or less abundance.

Dermacentor albipictus Packard, variously called "The Winter Tick", "The Horse Tick", and "The Elk Tick", is a very common species in the Northwest, more often seen on horses than on any other domestic animal, very abundant on the Rocky Mountain goat during winter and spring months, and common also on the elk. The spotted fever tick, as will be explained later, requires several hosts for the completion of its life cycle. *D. albipictus*, however, completes its life cycle on one animal instead of dropping off between stages. This tick is often more abundant on a given animal than is the spotted fever tick, and at times is a troublesome parasite of horses. We have taken upward of a pint of engorged females off of a single colt. It is not concerned in the transmission of spotted fever from animals to man. It does not bite man, or at least very rarely. There can be little doubt that some of Dr. Ricketts' experimental work with spotted fever was done with this species, although he was unaware of the fact at the time. In localities where both species are present, if a tick is found in abundance on horses during the winter months up to about the middle of March, it is almost sure to be *D. albipictus*.

Dermacentor variabilis Say, "The American Dog Tick", is the prevailing tick of the eastern half of the United States. In places it is abundant and it also occurs in California and Oregon. In recent years it has been found in

the eastern part of Montana and has been found as far west as Big Horn County. In experimental work laboratory workers have transmitted Rocky Mountain spotted fever with it, but as far as is known, it does not figure in as a means of infection with this disease in nature. We know of no reason why it may not become a factor in this disease of the human subject. It has been taken on many other animals beside the dog.

Haemaphysalis leporis-palustris Packard, "The Rabbit Tick", is very widely distributed in the United States and the various species of rabbits form its principal hosts. In the immature stages it has been taken on birds. It occurs very commonly in Montana; upward of a hundred sometimes being taken from a single rabbit. In recent years Dr. R. R. Parker has shown both that this tick is capable of transmitting Rocky Mountain spotted fever, and that individuals of the tick infected with this disease are found in nature. There is much reason to think that this tick is of considerable importance in the spotted fever complex.

Haemaphysalis cinnabarina Koch, was found in the Bitter Root Valley during the season of 1922 in fair abundance on the grouse. It is not an abundant tick in any part of the United States, and probably does not figure in the spotted fever problem in Montana.

Ixodes kingi Bishopp, "The Rotund Tick" is a species occasionally found in Montana on such hosts as the badger, wood-chuck, skunk, dog, and ground-squirrel. It is fairly common in the mountainous regions from Canada to Mexico. It is not concerned in the spotted fever problem as far as we know.

Ixodes texanus Banks, until recent years has been little known. It has been collected in Montana on the marten, the weasel, and the pine squirrel. It is a small species of rather rare occurrence, and of no significance in the spotted fever problem.

Ixodes angustus Neumann, is another little known tick, which is mentioned for completeness in this paper. It has been found in small numbers on ground squirrels, and is of no importance in Rocky Mountain spotted fever.

Ornithodoros megnini Duges, "The Spinose Ear Tick", has the habit of invading the outer ear passages of cattle and horses, principally the former. It is normally a species

of the southern range, being very common in the extreme southwestern states. In 1916 it was found in considerable abundance in the ears of cattle in the eastern part of Montana, probably having been introduced in shipments of cattle from the south. While we have not heard from it in recent years, it was formerly present through several years at least, showing that it is able to survive our winters. It has no bearing so far as we know on the spotted fever problem.

Zoological Position.

There is much popular confusion between true ticks, such as have been mentioned above and the common so-called "Sheep Tick". "The Sheep Tick" is a true insect belonging to the order Diptera, while the true ticks belong to another class of animals scientifically known as Arachnida, which includes also the spider, mites, and scorpions; ticks belong to the super-family Ixodoidea, a large group of blood sucking parasites, well distributed over the earth.

Geographic Distribution.

Persons residing in the Northwest often ask if the tick found in their locality is the same as the spotted fever tick, and if so why they do not have spotted fever. The spotted fever tick occurs in a continuous region which embraces all or parts of the following states:—Washington, Idaho, Montana, Wyoming, Colorado, New Mexico, Utah, Nevada, California and Oregon. As far as we know only the extreme northeastern corner of California has this tick. It also extends into British Columbia and Alberta, Canada, but just how far it extends we do not know.

Spotted fever is more or less prevalent in all of this region. Its distribution is confined to the area where this particular tick occurs. Spotted fever is found in varying degrees of severity over a large part of Montana, but seems to be present in a more virulent form in a portion of western Montana. Just why it is more virulent there is not known. The popular question therefore may be answered in this way: "Yes, it is the same tick commonly found in other parts of Montana and in these other states is not always infective, merely because it does not always carry the germ of this disease." The question is also frequently

asked, "Are new infected localities being found, and are the dangerous areas increasing in size?" We must reply that there is evidence that the disease is spreading.

Life History and Habits.

The spotted fever tick may be considered as normally occupying two years in completing its life cycle. The adult ticks, male and female, are found from March until early in July. After the hot weather comes on, they normally descend to the earth, if they have not had an opportunity to feed, and the tick season is thus closed by the coming of hot, dry weather. The adult ticks feed in nature on a list of the larger domestic animals, including horses, cows, and sheep, mainly, but also upon the mule, ass, dog, hog, and goat. Among wild animals they feed commonly upon the bear, deer, mountain goat, coyote, woodchuck, wild cat, badger, and rabbits. They insert their mouth parts into the animal and draw blood, gradually increasing in size, in case of the female, until one is as large as the end of the little finger; but in the case of the male, becoming little larger by feeding. Copulation takes place on the host-animal, one male often impregnating several females. Upon becoming fully engorged the female tick drops to the ground and seeks seclusion under some stone, chip, or waste, and deposits from three thousand to nearly eight thousand eggs. There is considerable variation in the time required for engorgement. About twelve days may be taken as the normal period. The length of time required for the hatching of the eggs depends somewhat upon temperature and varies between seventeen and fifty-one days. About four weeks may be taken as the normal period.

The eggs hatch into what are called "seeds" or larvae. These are minute, six-legged creatures, which hover together more or less, crawl upon the grass and wait for small rodents to pass within reach. When brushed by these rodents they scatter out on the fur and crawl into the skin, attach, and feed for from three to eight days. About six days is the normal period. The engorged seeds drop to the ground, seek seclusion, and go through a sort of transformation, remaining quiescent for from one to three weeks, when they emerge or molt from the larval skins, and appear as middle-sized ticks, or nymphs, which have four pair of legs,

as do the adults. This stage in their development is reached during the first season, in the middle and later part of the summer. These nymphs remain in hiding through the fall and winter and come up the next spring, hungry, and in search of a host. The hosts of both the seeds and nymphs are the same list of rodents, which includes the ground squirrel, chipmunk, pine squirrel, pika, mice of various kinds, pocket gopher, and the side-stripped squirrel. Not much discrimination is exercised by these early stages of the tick in selecting a host. The hosts used are probably those most available. Just about a week is required for nymphal feeding. After feeding on these various rodents, and having become engorged, the nymphs drop to the ground and go through their metamorphosis, and emerge from the nymphal skins as adult ticks, either male or female. The ticks appear as adults through the summer and early fall months. The quiescent period is variable with temperature, but occupies from six to ten weeks ordinarily. The adult ticks then hibernate at or near the surface of the ground and come up for feeding next spring, thus completing a two-year period.

From the above it will be observed that the ticks pass the winter, both in the unfed nymphal and unfed adult conditions, and that in the spring both the nymphs and adults may be collected on animals. There are then two parallel broods of ticks, one a year ahead of the other in its life cycle. The adults are of one brood and the nymphs are of another.

It is mentioned above that the normal life cycle appears to be two years in length. It is a remarkable fact that adult ticks failing to find a host during one summer of waiting, will descend to the earth again, when hot weather comes, and remain through the remainder of the summer, hibernate during the winter, and come up again the following summer in search of a host. Failing again the second year to find a host they will repeat the period of waiting until the next year and come up for the third time. In a few cases ticks under observation have been known to come up yet again, or the fourth year. Such ticks, then, have lived without food for four years. This remarkable thing is to be looked upon as an adaptation to offset the disadvantage the tick is under in finding a host. In connection with this we naturally

think also of the large number of eggs which the female may lay—nearly eight thousand. This large number is to offset the small probability that an individual tick will find the succession of hosts and be successful in reaching the adult condition. Thus, considering that on an average only one pair results from the reproducing of a parent pair, the chances are about one to four thousand against the tick, for the number of ticks in a given locality does not vary greatly from year to year if left undisturbed.

Tick Conditions.

One often hears it stated that one kind or another of natural surroundings is favorable to ticks. Some think of pine trees as being favorable, others think of sage brush, and still others, grassy hills. We should consider as favorable tick conditions, those conditions which allow the hosts of both adults and immatured ticks to continue in the same locality. Vegetation and physical conditions have their influences indirectly in affording suitable surroundings for the animals which are the hosts of ticks, and ticks once established will continue in a locality where there are horses, cattle, or sheep, among domestic animals or any of the large wild animals mentioned as hosts, occurring together with rodents which afford hosts for the early stages of the tick in the same locality.

Ticks as Parasites of Man.

Ticks are normally parasites of wild animals. They have become parasited of domestic animals and of man because man has gone into localities where they are present. There can be little doubt that the coming of man with his domestic animal has led to an increase in abundance of ticks. Ticks are not normally a parasite of man but maintain themselves in a cycle on wild animals. Ticks are outside of their normal habitat when acting as parasites of mankind.

Fig. 1. The Winter Tick or Horse Tick (*Dermacentor albipictus Packard*). Female above, male below. Often confused with the spotted fever tick in the northwest and particularly abundant in the spring on horses in some localities.

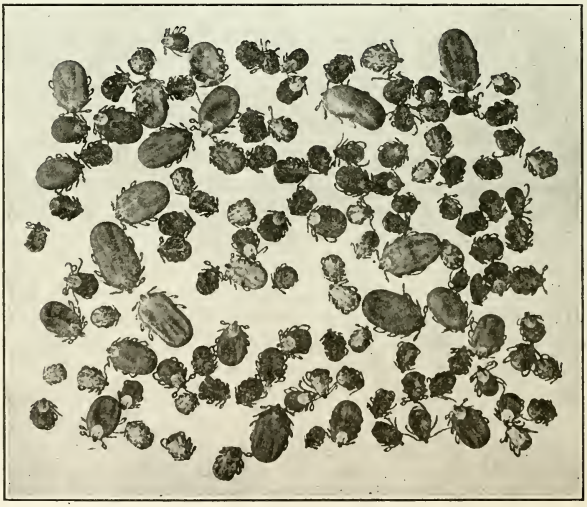


Fig 2. Spotted Fever Ticks, Male and Female. Females in various stages of engorgement. —Photographs by R. A. Cooley, State Entomologist.

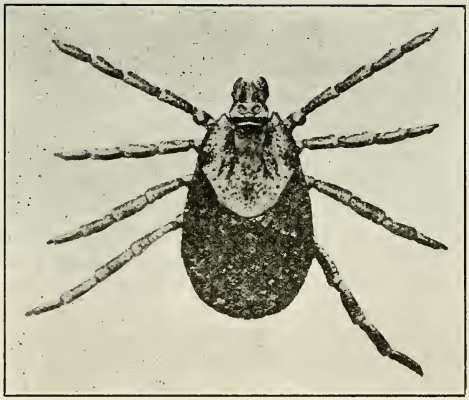


Fig. 3. Female Spotted Fever Tick. (*Dermacentor venustus Banks*).

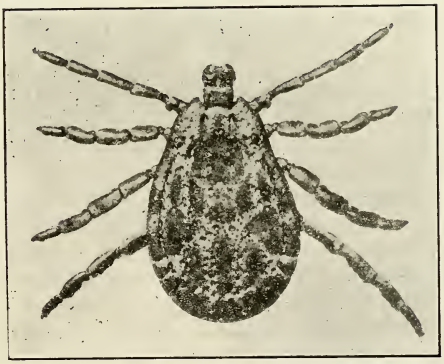


Fig 4. Male Spotted Fever Tick. (*Dermacentor venustus Banks*).
—Photographs by R. A. Cooley, State Entomologist.

THE PREVALENCY AND DISTRIBUTION OF ROCKY MOUNTAIN SPOTTED FEVER IN OREGON.

By

FREDERICK D. STRICKER, M. D.

State Health Officer, Oregon.

For over thirty years "spotted fever" has been looked upon as a distinct disease by the physicians of Eastern Oregon. In 1889 Maxey wrote in the Portland Oregon Medical Sentinel of "an independent specific disease and related in no way to any disease described in our textbooks or practice." The first official records are two deaths recorded in 1904. Up to this time no death records were required in this State as the Oregon Board of Health was not organized until 1903. The disease prevailed many years before this and was well known to the early practitioners. It was considered by them a mysterious disease with a considerable mortality.

The mortality in Oregon is much less than in Montana and somewhat higher than in Idaho. From the studies of the disease made in this State, we believe the death rate to be approximately about eight per cent, but this cannot be definitely stated until a complete survey is made.

The symptoms of the disease in Oregon are not unlike those in Montana and Idaho. The incubation period is from three to seven days. The onset is usually gradual with loss of appetite, lassitude, general malaise and chilliness. Pains are referred to the bones, muscles, back and joints. Patient has headache and is restless and sleepless. The chill is followed by fever rising to 103° and is continuous throughout the case with slight morning remission. Patient is constipated. The characteristic feature of the disease of course, is the eruption, which commences on the fourth to seventh day. It occurs first on the ankles and wrists extending to the back and in two or three days covers the entire body. The eruption is at first macular but in two or three days becomes petechial. In about two weeks the eruption begins to fade. The eruption frequently is found on palms of hands and soles of feet.

The fever is continuous, runs about two weeks and in favorable cases the recovery is by lysis. In unfavorable

cases, the skin becomes hyperesthetic, the eruption darkens, becomes hemorrhagic and confluent, and death is preceded by delirium and coma. The complications are pneumonia and gangrene.

Before the nature of the infection was known, there were many theories in regard to the origin of this disease. A "miasma" and certain sources of drinking water were considered causes. The Indians called it the bite of the "white spider". But the frequent association of tick bites with the cases was noted by most of the physicians treating these cases. An early story states that the infected ticks were brought into this State by horses driven from Montana. Local physicians have attempted to trace the extension of this disease through cattle being brought in from infected regions. The disease is indeed mysterious and the more study one gives it, the more perplexing it becomes. One thing is certain though, this disease is increasing in Oregon as will be shown by the following table. In compiling this table, it has been necessary to estimate the number of cases. In making our estimate, we have used the figures in localities where the reporting has been good. In spite of the serious nature of this disease, many physicians have not made any effort to report this disease. The reason given by one physician is characteristic—"This disease is not contagious —they cannot make me report it." Physicians of this type of course do not merit the name of scientific men and the entire profession suffers for their selfish disregard of the value of human life.

After a careful consideration of the situation, we believe that our figures are not far from the real number of cases occurring in this state.

Year	Deaths	Estimated No. of Cases	Months of Infection
1913	3	36	April, May June
1914	2	24	April, May
1915	3	36	April, May, June
1916	4	48	May, June, July
1917	4	48	May, June, July
1918	2 (?)	24 (?)	May to September
1919	5	60	April, May, June
1920	5	60	April, May, June
1921	7	84	April, May, June, July
1922	8	96	April, May, June, July

The infection has gradually been increasing in Oregon and it would be interesting to know what the factors in this increase are, but more important than this is some means to reduce the prevalency of the disease and prevent its annual recurrence.

The months of June, May and April are given in order of the frequency of the disease but cases have been reported as early as February and as late as September.

Spotted fever is confined to Eastern Oregon as no cases have ever been reported west of the Cascade Mountains. The Central part of Eastern Oregon is the region in which the infection is mostly found. The disease is found in the valleys and is usually contracted in or near the foot-hills of the mountains. The cases are sporadic and no cases of contagion have been noted.

In this State, the problem is still an unsolved one. No definite measures have been taken to stamp out this disease. We are making a study of the situation and are hoping that conferences of this nature will stimulate research so that preventive measures will be found sometime in the near future. The Oregon State Board of Health plans to make a survey of the infected districts.

ROCKY MOUNTAIN TICK FEVER IN THE STATE OF WASHINGTON.

By

A. U. SIMPSON, M. D., Epidemiologist,
Washington State Department of Health.

There have been reported thirty-three cases of Rocky Mountain Tick Fever since 1907. This number includes three cases of tick paralysis and one of a local infection causing death.

In 1907 Doctors Moore and Woodward of Seattle reported two cases. One patient came from Crab Creek near Odessa, and we find that the other case occurred in Maple Valley, King County, and gave a history of having done, a short time before, construction work in Montana.

Dr. Barnhart, County Health Officer of Spokane, wrote as follows in 1920:

Re case of Mr. A.—age 53: "When I first saw him

there was a marked toxic condition, fever was 101 and 102 with a relatively slow pulse, for instance, temperature of 100.4, pulse 70. The spots came out early in the disease, were hyperemic, were about a sixteenth of an inch in diameter, very uniform and general. Over the forehead the spots were tender. The urine was normal. Blood examination, including Wassermann, was negative; a Widal was negative. The fever fell by lysis; and pain in the pit of the stomach, which was most prevalent during the afternoon and evening, responded very nicely to the ice-bag, and subsided in about four days after patient entered the hospital. Patient had been under the care of two other doctors before coming to me, had not been in Montana since early last fall and had not been in the Bitter Root country.

"He lives on a ranch nine miles south of Spokane, had been doing the general work about the ranch, and gives no history of a tick bite, neither could we find any tick after a pains-taking examination of the entire body.

"I had seen, five years ago, a case in all respects like this one with the exception of the pain in the pit of the stomach; the patient had come directly from the Bitter Root Valley, his sickness ran a similar course, and he made a complete recovery.

"I was very much interested in this present case, particularly because my own little girl, aged eight years, had shown symptoms of paralysis of the legs and marked nervousness, and when given a complete examination showed an ordinary wood tick attached in the right axilla. Her blood examination showed a high percentage (11 per cent) of eosinophiles. The paralysis, of an incoordinating type, disappeared completely in about four days. This is the second case of paralysis in young children occurring in my practice; both cases were seen by Dr. P. D. McCormack of Spokane."

Dr. Winslow of Seattle describes a case in the Northwest Medicine, September 1921, as follows:

"Mr. K.—age 46, returned to Seattle on May 5, 1921, after a five day's sojourn in a sheep district near Mountain Home, Idaho, and was suddenly stricken with fever, chilliness and weakness on the very day of his return. On the third day of his sickness a discrete papular eruption appeared on his neck and face,—this extended to his chest,

back and abdomen and was accompanied by severe pains in his legs which continued for three days more. About the same time a dark red macular eruption broke out, first on the legs and later on the arms and became petechial. The hemorrhagic spots became more or less confluent and some were nearly as large as the little finger nail. There were no catarrhal, respiratory or digestive symptoms. He was held in the City Hospital twenty-four hours as a smallpox suspect.

The spleen was easily palpable but not so the liver. There was no general glandular enlargement. The abdomen was slightly tympanitic. The leucocyte count was 8,000 with 76 per cent of polymorphonuclears and 24 per cent of mononuclears. The Wassermann test was negative (Dr. Magnusson). The urine was normal and a blood culture was sterile.

"On questioning the patient it seems that the residents of the district in Idaho near Mountain Home, where he had stayed, told him he was lucky to escape without tick fever which was very prevalent there at the time of his visit. Moreover, a wood tick was discovered on his body after his return to Seattle. * * * * *"

L. G., Spokane, died May 28, 1921. Cause of death "wood tick bite causing bulbar paralysis." Reported by Dr. O. Stenberg.

D. J. O'C.—Hillyard. Onset April 27, 1922. Prior to commencement of illness was on a work train at Odessa. Dr. J. Farrow reports case.

J. C., Wilbur. Was taken ill about May 1, 1922. Died on May 22nd. Dr. Maier removed three ticks. The infection extended over the abdomen and into inguinal glands which suppurated. Dr. Cunningham further states that "in 1922 there were several cases of wood tick infections in this region. Some exhibited only a local infection while others developed spotted fever. The local infections were the more severe of the two."

R. C., Lamona. Was taken ill on May 1, 1922. Ticks were found upon his person. Mild case. Eruption marked on face, arms and chest, but very scattered over the rest of his body.

H. E. M., Odessa, fell ill on May 14th. He was fishing on Crab Creek near Irby. Ticks were found. The eruption

was very marked, covering his entire body, beginning on the face, arms and chest and spreading all over. These two cases reported by Dr. Lee Ganson.

J. P., onset May 30th. Was working on a ranch near Lamona. There are many ticks in the sage brush near Downs, Washington. There is surely an area between Downs and Lamona, Washington, and north of Lamona, infected with these spotted fever ticks, as there have been about six cases of spotted fever from this district in the last six weeks, Peterson being the last. The first cases that appeared were not diagnosed although seen by many doctors at Spokane. Dr. L. F. Wagner, Harrington, reported this case.

L. D., Spokane, onset June 9th, died June 17th. Spent vacation at Twin Lakes, Idaho. Ticks are more or less frequent in this district. No ticks found on his person.

T. H., Lamona, onset August 14th. There are plenty of ticks in the sage brush in this area. Other cases noted earlier in the season. Ticks now about all gone owing to lateness of season. Reported by Dr. L. F. Wagner.

Mr. B. C. Holmes, Game Warden of Lincoln County, informed us that in 1920 a great number of rabbits were in this territory. A lesser number were found in 1921 and still fewer in 1922.

The infested area extends from the Grand Coulee to the State line, including part of Grant, Lincoln and Spokane Counties. The majority of the cases of Rocky Mountain tick fever have originated along Crab Creek. The ticks of this region not only cause spotted fever, but also tick paralysis and severe local infections.

INCIDENCE OF ROCKY MOUNTAIN SPOTTED FEVER IN WYOMING.

By

ALBERT B. TONKIN, M. D.

State Health Officer, Wyoming.

Rocky Mountain spotted fever (tick fever) is by no means new to Wyoming. It was not diagnosed by this name until about 1902 at which time studies by research men of a similar condition occurring in Montana, and

which had a great mortality, were given a great deal of publicity and while such a name was in more or less use where the disease was prevalent it was not generally called such in Wyoming until about that time. It was previously called in this state mountain typhus, mountain sickness, mountain fever and other such terms. There is no history showing undue prevalence of this disease in Wyoming prior to about 1898, but that it was prevalent in the State for a number of years back there can be no doubt. Older Indians with whom I have conversed have told of such a condition, known to them as the blue disease, or mountain sickness. Unlike in Montana, however, the Wyoming Indians did not describe the disease as appearing in any one definite location and neither did these Indians, as have those of Montana, ever associated the appearance of the disease in any definite isolated locality with various spirits. The Montana Indians carefully avoiding such definite localities at the certain seasons when the spirits were supposed to be present. The mortality in Wyoming not being so severe, the Indians here paid less attention to it than they did in Montana.

The earlier cases of this disease that can be probably ascribed to Wyoming, however, did seem to have a definite geographic centralization, and seemed to follow up the Sweetwater River from the Pathfinder Dam over the Wind River Mountains to about the Green River and down the Big Horn River to the spot where now stands the town of Lovell. Older physicians have furnished me with descriptions of a disease that was undoubtedly spotted fever, sporadically occurring in their practices as far back as the eighties, and while there is little or nothing that has ever been written regarding the same and while the disease was not common in those days, it was undoubtedly present.

In the summer of 1909 while attending a case of spotted fever, I was brought in contact with a man, an old time prospector who had crossed the plans into Wyoming during the days of the bull trains, and when I told him the case that I was then attending was a case of tick fever he said, "Well, I thought it was a case of what we used to call trail typhus"; further questioning of him elicited the information that in those earlier days the overland emigrants were particularly afflicted with a disease

known as trail typhus. The disease according to him was similar to the case at hand and that this disease became evident among the emigrants especially at the point where the trail joined the Sweetwater River about at Independence Rock, and that it seemed to disappear among them after crossing the Green River. It is regrettable that authentic information of this kind of unobtainable, or has not been obtained, but I firmly believe that it is more than possible that, while the life of the emigrants was such that pre-disposed to typhus, especially in our present light of the knowledge of the cause of the same, yet these same habits would have manifested the true typhus prior to reaching this point and at further points along the Trail.

Distribution of the disease in Wyoming for the year 1922 shows that cases of tick fever were reported from practically every county in the state with the exception of Platte, Goshen, Crook, Campbell and Laramie. With the exception of 1915 none of these counties have ever had a case of this disease reported to the office of the State Board of Health so far as records show. In 1915, however, there were about four cases of this disease reported from Campbell County and five cases reported in 1917 from this same county. Cases occurring in Platte and Laramie Counties have generally proved upon investigation to have originated from some other county. That part of Lincoln County, which in 1923 became Teton County, has no record of any cases originating there.

The majority of cases reported in 1922 had their origin as being from Fremont, Big Horn, Park, Sheridan, Johnson, Natrona, and Sweetwater Counties in their order named and all investigations show that these counties have always had the greatest number of cases reported, whether due to the greater prevalence of the disease or due to the cooperation of the physicians in reporting their cases is debatable.

However, for 1922, reports were practically 100 per cent accurate and they will have to be the criterion as being the counties where the disease is most prevalent. In comparison with the prevalence of the disease in the state for the past several years it is very difficult to say as to whether the disease has been consistently on the increase or as to whether the incidence of 1922 was due to a cycle.

In Fremont County, where I had been practicing for a number of years, the disease was not so prevalent as in other years, yet probably shows a gradual tendency to increase.

For the entire state of Wyoming during the year 1922 there were seventy-two cases of the disease reported with a total of nineteen deaths showing that this year the mortality was about 26 per cent. The mortality for Wyoming has been generally assumed to be about 15 per cent. According to the race, mortality is greater in the Indians than in the Whites, the reason for the higher mortality among the Indians probably being due to the existence among them of concomitant disease conditions.

So far as the seasonal influence in Wyoming is concerned the first case generally manifests itself in the very first part of April, the number of cases gradually increasing, May and June becoming the months of greatest influence, a few cases occurring in July, rarely a case in August and the latest I ever saw or heard reported manifested itself on September second. These late cases in Wyoming generally were contracted after an exposure in higher altitudes.

There are several other medical and surgical conditions presenting themselves to the people of Wyoming that are due to the bite of ticks, other than spotted fever. Cases are on record, I have attended a number myself, whereby people have been so numerously bitten by ticks that several days of illness with marked constitutional symptoms which resemble closely the prodromal stage of spotted fever but not followed by the characteristic rash. As to whether these are cases of a mild infection that probably will render immunity to the person affected I am unable to say but I do think it is within the range of possibility.

Frequent cases of sloughing of the skin at the sight of a bite have occurred, and have been reported, following with rather marked and lymphatic involvement and complications. I have thought that these probably might be cases of tularemia and I have attempted definitely to do some work along this line. I firmly believe that investigations of this nature would definitely determine that these cases are without doubt tularemic in nature and that the

tick can and does also transmit bacillus tularence. Many cases of severe septic infection and cellulitis are on record, these latter probably being due to infective material being introduced by the mandible of the tick or through the insertion of infective material following the attempts to remove the heads and mandible by the individuals themselves. I have been unable to ascertain or have I ever heard or found reported any cases of tick paralysis in the State of Wyoming.

State Board of Health Reports for the disease in Wyoming in 1913: Four cases with four deaths; 1914, twenty-six cases with four deaths; 1915, fifty-nine cases with eight deaths; 1916, twenty-six cases with eight deaths; 1917, seventen cases with five deaths; 1918 and 1920, no cases reported; 1921, three cases reported by death certificate only; 1922, seventy-two cases reported with nineteen deaths. The incidence of mortality is about the same in each county and bears about the same relation according to the morbidity.

No effort or appropriation has ever been made in Wyoming to investigate the disease thoroughly and no particular interest has ever been manifested by the legislative authorities in carrying out any studies of the same nor in connection with rodent control such as has been carried out in Montana. While many dollars have been appropriated for rodent control in the State of Wyoming in connection with the agricultural development of the state and the saving of the crops none of this latter work has been as a result of any effort to better health conditions or destroy these rodents because of their probable influence upon the incidence of spotted fever in the State of Wyoming.

THE PRESENT STATUS OF ROCKY MOUNTAIN SPOTTED FEVER IN IDAHO.

The early history of Rocky Mountain spotted fever in Idaho is very obscure, as is true of other areas of infection in the northwestern states. Such knowledge as we have we owe to an extended and valuable study made by Dr. E. E. Maxey in 1908. Since 1915, however, no data have been available.

A recent survey made by the Public Health Service has

shown that the disease is less prevalent than in former years and that there has been a slight extension of the known areas of infection.

The following table gives the case records by years so far as they are available. Prior to 1909 Maxey has estimated that the average number was in excess of 375 each year.

1909	363	1916	151
1910	no data	1917	159
1911	334	1918	103
1912	197	1919	166
1913	258	1920	175
1914	386	1921	198
1915	360	1922	168

It is apparent from the table that the average for the past eight years shows a decrease of about 50 per cent. The reasons for this decrease are not entirely clear, but the extension of agriculture, precautions against tick bites and campaigns against rodents may all have been concerned.

In contradistinction to this decrease in Idaho, increases have occurred in Oregon, Wyoming and Eastern Montana.

Maxey's studies showed that the fever was largely confined to the valleys of the Snake River and its tributaries, only a few cases occurring in the northern part of the state. The recent studies indicate that this still holds true, nevertheless there have been slight extensions of known areas of infection in the southern section and further spread seems likely.

CONTROL METHODS IN THE REPRESSION OF SPOTTED FEVER.

By

W. J. BUTLER, D. V. S.

State Veterinary Surgeon, Montana.

In the repression of spotted fever by control measures the most important question that presents itself is: "Is spotted fever a disease of the tick, or is it a disease of some animal and the tick simply an intermediate host?"

Until this question is settled we cannot hope to repress or eradicate spotted fever by control measures alone. If

spotted fever is a disease of some animal, the problem of eradicating it is simplified, in that all that would be required would be to exterminate that animal or in some other way keep ticks from feeding on that particular animal. If spotted fever is a disease of more than one animal, the problem becomes more difficult but not insurmountable.

If spotted fever is a disease of the tick itself, then the eradication of the disease by control measures alone appears to be well nigh insurmountable on account of the life history of the tick, its longevity, and geographic conditions of the country in which it lives.

The preponderance of evidence at the present time leads one to the belief that spotted fever is a disease of the tick itself. This has not been proven, and is simply a conjecture. It is to be earnestly hoped, however, that this question will be settled definitely before very long. Until it is settled, sanitary officials must work in the dark in the promulgation of control measures.

The Montana State Board of Entomology in its endeavor to control and prevent the spread of spotted fever from the Bitter Root Valley provides that:

1. All domestic animals in a quarantined area will have to be dipped periodically or otherwise freed and kept free of ticks by spraying, carding or hand picking, at such times and in such manner as the officer in charge of the work may prescribe.

2. Badly infested areas are quarantined and domestic animals are prohibited from being shipped in or out of these areas during the tick season (March 1 to July 15), unless such animals are examined by a representative of the Montana State Board of Entomology, and found free from tick infestation.

3. Domestic animals are prohibited from being turned out and running on the open range during the tick season.

4. All ground squirrels and other rodents in control districts must be poisoned or otherwise killed and exterminated.

Compulsory dipping of animals was found to be impracticable due to geographic and climatic conditions. To one conversant with the Bitter Root Valley this needs no

explanation, as in this section snow storms and cold weather are prevalent during the spring months. It is impracticable to dip animals during inclement weather. It naturally follows that many animals were not dipped at the end of the period which required their dipping. Milk cows cannot be periodically dipped in an arsenical solution, without unfavorable results. For these and other reasons the compulsory dipping of domestic animals was discontinued, and pastured animals were permitted to be kept free from ticks by hand picking in lieu of compulsory dipping.

With reference to the regulations governing the destruction of rodents, it may be said that the law of Montana (Chapter 27, Session Laws 1919) provides authority for the State Board of Entomology to establish control districts and require the owners of land in any such district to poison or otherwise kill and exterminate ground squirrels and other rodents. It further provides authority for the County Commissioners to appoint agents under the supervision of the State Board of Entomology to do such work. It specifies that a maximum charge against any parcel of land shall not be greater for any one treatment than at the rate of $8 per 160 acres, and that the charge for such poisoning if not paid directly by the owner shall be added by the County Treasurer to the taxes upon such property and collected the same as provided by law for the collection of taxes for state and county purposes.

Chapter 24, Session Laws of 1923 provides additional authority to the State Board of Entomology and the County Commissioners for the destruction of rodents in control districts. This law provides authority for the County Commissioners to levy a tax of not to exceed one-half mill on the dollar on assessed valuation, which money is to be used solely for the destruction of rodents which may be infested with ticks that are capable of carrying infection of spotted fever.

One of the phenomena of spotted fever is that ticks in one locality carry an organism of extreme virulency, while ticks in a neighboring district apparently are not infected. Why this is so has never been definitely established. The fact remains, however, that such a phenomena does occur which leads one to the opinion that spotted

fever may become more prevalent and virulent as the tick or the virus of the disease becomes indigenous to certain feeding and certain soil conditions.

The control of spotted fever is not a problem of the Bitter Root Valley alone. It is a national problem. Spotted fever is found in practically every rocky mountain state. The disease in the Bitter Root Valley has received more attention due to the fact that investigational and research work has been carried on to a greater extent in that district than in any other district affected with the disease. It is also recognized that spotted fever in the Bitter Root Valley is of a more virulent character than spotted fever found in most other sections. Nevertheless, if the virus of spotted fever should happen to locate itself in a country where the feeding and soil conditions are similar to those of the Bitter Root Valley it might follow that that virus would develop into the virulent strain, and cause as great a percentage of mortality as is encountered in the Bitter Root at the present time.

Fifteen or twenty years ago spotted fever in eastern Montana was unknown. It was not until after the horse sale yards at Miles City had been established that spotted fever made its appearance in that district. These yards were established about 1904 or 1905. At that time only local horses were sold. However, it did not take long to diminish the local supply of light horses, and horse speculators turned their attention to Idaho, Nevada, Washington, and Oregon. They went out into these states in the early spring months and shipped in light horses. These animals were sold at the Miles City yards to local buyers, who took them out on to the range north and south of Miles City. They were run on this Montana range during the spring and early summer months, and were brought in again to the sale yards at Miles City during the months of June, July, August, and September and sold to outside buyers. The reason for this procedure is simple.

When these light horses arrived from states further west they were generally in very poor condition. Local buyers purchased them at a very low figure. They shipped them out to their range where at that time there was plenty of grass and in a few months these animals fattened

up and improved in appearance one hundred per cent. When resold they brought in many instances $10 to $20 profit.

What has this to do with spotted fever? Simply this —these light horses arrived in Montana during the months of February, March and April and were infested with ticks. Is it not possible that a number of these ticks may have carried the virus of spotted fever? Certainly it is a fact that there is no record of spotted fever in eastern Montana until several years after the introduction of these horses.

It is also recognized that there are more ticks in eastern Montana today than there were some years ago. It is true that the rabbit may be an important factor in the increase of ticks, but the rabbit has been in eastern Montana since before the white man came to this country, and light horses were not shipped in in any quantity from western states to eastern Montana until after the establishment of the horse sale yards at Miles City.

1. The evidence on hand at the present time indicates that ticks infected with the virus of spotted fever are carried from one section of the country to another by domestic animals.

2. The theory that spotted fever virus becomes more virulent under certain soil and feeding conditions is also tenable.

3. Spotted fever is a disease that has manifested itself in Canada and in the several Rocky Mountain and adjoining states.

With these factors alone in mind, spotted fever must be considered a national problem and not one simply of the Bitter Root Valley or any other isolated section.

MAINTENANCE OF THE VIRUS OF ROCKY MOUNTAIN SPOTTED FEVER IN NATURE WITH PARTICULAR REFERENCE TO CONDITIONS IN THE BITTER ROOT VALLEY.

By

R. R. PARKER, Special Expert,
United States Public Health Service.

The studies made in the Bitter Root Valley by Dr. H. T. Ricketts during the period of 1906 to 1909 indicated that Rocky Mountain spotted fever is normally a disease of small wild mammals; that it is transmitted by the bite of a wood tick; and that its maintenance is not dependent in any way upon human infection.

Because of these findings a cooperative pathological, entomological and zoological investigation had been planned to study the disease as it exists in nature. This venture was scarcely initiated, however, when the unfortunate death of Dr. Ricketts brought it to an end.

Except for the work of Dr. McClintic of the Public Health Service in 1911 and 1912, which was likewise terminated by an accidental infection, no further work along this line was attempted until the Service again took up the problem in 1921, the Montana State Board of Entomology having in the meantime, made observations suggestive of its value.

During this interval entomological studies on the life history and habits of the tick were carried on by Professor R. A. Cooley of the State College, and by Messrs. Hunter, Bishopp and King of the Federal Bureau of Entomology. These resulted in findings which suggested means of controlling the infection by the control of its transmitting agent, the wood tick. Control work, as thus far carried on in the Bitter Root Valley has been principally based on the entomological data then secured. In an area of similar size, more favorably situated, there is every reason to believe the same amount of effort would have resulted in practically complete control; but under the very difficult

conditions prevailing in the Bitter Root region, progress has been slow and the results secured lack the permanency which is much to be desired, if attainable.

Knowing this, the question as to whether or not a more extensive knowledge of the conditions which contribute to the maintenance of the infection in nature might point to a more satisfactory control procedure, has continually presented itself. That studies along this line might yield information of value was thought possible because the accumulated epidemiological data indicated that some natural control agency is operative in nature.

Whatever this agency may be its presence has been suggested by an apparent cycle in the occurrence of human cases both in regions and in localized areas of infection. This periodical occurrence of cases has been observed too frequently to be attributable to chance alone. If a natural control actually takes place, and if the conditions that make it operative can be sorted out of the spotted fever complex which exists in nature, it may be that the knowledge thus gained can be turned to practical use. To try to solve this puzzle is one of the problems upon which the Public Health Service is now working.

It is not the purpose of this paper to go into details of this investigation but merely to discuss the spotted fever complex in a very general way.

On the basis of our present knowledge it seems reasonable to assume that the following factors are those which contribute to the maintenance of spotted fever:

1. Stage to stage transmission of the virus by the wood tick. *Dermacentor venustus.*
2. Stage to stage transmission of the virus by the rabbit tick. *Haemaphysalis leporis-palustris;* and
3. The starting of new "lines" of infection in ticks by the feeding of non-infective ticks on the blood of an infected host.

The importance of each of these main factors is controlled by environmental conditions, such as

(1) The species of host animals present;
(2) The relative abundance, distribution and habits of host species;
(3) The susceptibility of host species to infection;
(4) The habits of the tick species;

(5) The character of any region concerned; and
(6) Conditions which may affect the existence of, or the infectivity of, the virus as it occurs in ticks.

This then is the complex upon which we are working.

It has been suggested that the etiological agent of spotted fever may be a parasite of the tick, rather than that the tick acts as an intermediate host. There is no special evidence, at present, to support this idea, but, even if it should be true, there are no apparent avenues for the spread of the infection among ticks except those listed above, unless it be by the act of copulation.

1. Stage to stage transmission of the virus by the wood tick.

The transmission of spotted fever virus from larva to nymph, nymph to adult, female to egg, and egg to larva has been amply demonstrated. The value of this means of maintaining the virus is limited by two conditions:

(1) The high mortality rate among the ticks; and
(2) By the effect of environmental conditions on the virus in ticks.

Our knowledge of the complicated life history of the wood tick and of its relative abundance from year to year make it certain that these ticks are subject to a very high mortality rate; so high, in fact, that the average chance that more than a few of the young of an infected female will reach maturity and reproduce is quite small. This high death rate is due to starvation (because of failure to secure a host), unfavorable conditions of environment (e. g., temperature, moisture) and, doubtless, to some extent, to efforts of host animals to rid themselves of infesting ticks. Of importance in this connection is the possibility that not over fifty per cent of infected females transmit the infection to their offspring. Even when such transmission occurs it is not certain that all daughter ticks will be infected. Be that as it may, it is certain that the potential value of stage to stage transmission in maintaining the virus is greatly lessened by a high mortality among the ticks even if other adverse conditions are not involved.

The consideration of the effect of environmental conditions on the virus in ticks comes next. There is no

definite information on this subject but some of our observations suggest that there are conditions that are unfavorable to the continued existence of the virus. Such conditions may, perhaps, exist in the tick itself or, possibly, some external condition, such as temperature or moisture, may be concerned; perhaps both.

Whether or not, under favorable condition, the virus of spotted fever can be indefinitely maintained in the descendants of an infected female is not known but it is felt to be doubtful if stage to stage transmission alone is sufficient to maintain the disease in nature over extended periods of time. It is certain, however, that it must be considered as a contributing factor.

2. Stage to stage transmission of the virus by the rabbit tick.

The rabbit tick has but recently been shown to be infective and our data suggest that stage to stage transmission takes place as in the wood tick. This tick is found on all species of native rabbits, infesting some to a greater extent than others. It does not bite man. Therefore our interest in this tick is concerned with the extent to which its ability to transmit the fever affects the occurrence of the virus in the wood tick. Since all species of rabbits are hosts of both species of ticks it is evident that these rodents are media through which infection may be passed on from rabbit ticks to wood ticks.

What percentage of tick infection originates from this source?

Can the rabbit tick carry the infection over periods which are unfavorable for wood tick infection?

Does the passage of the virus through rabbits and rabbit ticks affect the virulence of the virus when subsequently acquired by the wood ticks?

These are some of the questions suggested but they cannot be answered at the present time. That some part of wood tick infection is derived through rabbits cannot be doubted and in sagebrush areas, such as Eastern Montana and Southern Idaho the percentage is probably large. The fever in wild rabbits is usually very mild, and only a very mild type of infection is found in rabbit ticks, as our recent studies have shown. Perhaps these points may have

some bearing on the mild type of human infection which occurs in areas of the northwest which support a large rabbit population and in which it seems certain that the infection passes through rabbits much more frequently than in the Bitter Root region.

The conditions noted above, (i. e., mortality rate and environmental conditions) as affecting the continuity and infectivity of the virus in successive generations of wood ticks must also play a similar role in the rabbit tick. In comparing the two ticks from this standpoint, however, the following points should be considered:

1. The correlation of habits of rabbits and the rabbit tick are such that the chance that the offspring of a female rabbit tick will reach maturity is doubtless greater than for the wood tick.

2. The average number of rabbit ticks per host animal greatly exceeds that of the wood ticks (on rodents that are hosts of immature wood ticks).

3. The rabbit tick is potentially able to transmit infection from two to three times as often as the wood tick since it is likely that the former completes its life cycle in one year whereas the latter requires three seasons.

4. With respect to environmental conditions, such as temperature and moisture, the rabbit tick, because of the type of country frequented by its hosts, is subject to less extreme conditions.

In closing this part of the discussion the most that can be said is, that there is much to learn about the relation of the rabbit tick to spotted fever and to the maintenance of the virus.

3. The starting of new "lines" of infection in ticks by the feeding of non-infective ticks on the blood of an infected host.

It does not seem possible to doubt that new "lines" of tick infection are started by the feeding of non-infected ticks on the blood of infected hosts. Certainly the starting of new tick infections in this way contributes to the maintenance of the virus but the value of this contribution depends, first, on the number of infections thus started and second, on the dangers that attend stage to stage transmission. The number of infections thus started is

determined by such factors as: (1) the available number of non-immune individuals of susceptible species of rodents and their distribution, (distribution is largely determined by the character of the country), (2) the number of ticks, (3) meteriological conditions (which affect the activity of both the ticks and their hosts), (4) the habits of ticks, (5) the habits of host animals, (6) the number and availibility of adult tick hosts, and (7) such conditions as determine the infectivity of the virus in ticks. Factors such as rodent abundance, tick abundance and others of those mentioned vary from year to year and in different localities and regions of infection. Hence it follows that the number of new infections started in ticks will also vary according to year and locality.

This variation, then, should result in corresponding increases and decreases in the number of infective ticks. That such is the case seems to be indicated by the alternate increases and decreases in the number of human cases which have been previously referred to as occurring in many areas of infection. If this apparent correlation actually exists then there should be some justification for feeling that the starting of new tick infection each year is more fundamental as a means of maintaining the virus than is stage to stage transmission and conversely it would follow, that the latter means alone is not all-sufficient. This would point to some one more of the factors that control the number of new tick infections as the keystone of control. However, this is interesting at the present time purely from a speculative standpoint and it is useless in this paper to attempt to penetrate further into the spotted fever complex.

For several reasons the actual field work has thus far been confined almost entirely to the Bitter Root region of infection, and in concluding a few of the results secured during the first season's work will be noted.

The per cent of infected ticks that occur in nature has always been an interesting question. During 1922 tests of over 5,000 adult ticks showed a minimum of 1.6 per cent to be infected. The actual percentage can be conservatively placed at 2.

Three hundred and twenty-two tests were completed with immature fever ticks from rodents and more than 20

per cent of the infested rodents were found to be carrying infected ticks. Tests of those secured from ground squirrels showed a minimum infection of 2.4 per cent. Of infested snowshoe rabbits 35 per cent carried infected ticks. Porcupines, hitherto unsuspected, were found to be important hosts of adult ticks and our results suggest that they are susceptible to infection.

Our knowledge of the rabbit tick in the fever complex was added to by the discovery that several species of grouse are efficient hosts of its immature stages. Infected ticks were among those secured. Game birds, then, play a role in spotted fever as hosts of an infected species of tick and as agents in their distribution. Rabbits and grouse inhabit the same type of country and their habits have much in common.

Field studies in the Bitter Root region deal with two sets of conditions with respect to the ticks, mountain conditions and valley conditions. Infected ticks are present in both mountains and valley, but animal population (both large and small mammals), animal distribution, tick habits and many other conditions are different. It was found last year that the per cent of infected ticks was much higher in the mountains than in the valley, our tests showing a minimum of about 5 per cent. These high percentages of infection were found among the ticks collected from the mountain goat ranges high up on the mountain sides. Furthermore, mountain goats examined carried approximately the same proportion of infected ticks. It seems evident that the infection is carried to the canyon floors from the mountain side areas and thence out to the valley. It is interesting that mountain goats, a species that is not itself susceptible to infection, is largely responsible for the large number of infected ticks. This happens because it is practically the only animal in the localities concerned that serves as a host to the adult ticks. Its elimination would certainly greatly reduce the number and probably indirectly, the per cent of infected ticks in the mountain canyons. To what extent this would affect the valley infection is not yet apparent but it certainly should improve conditions at the mouths of the canyons where infection is usually heavier than in the valley proper.

The above discussion of the factors that contribute to

the maintenance of Rocky Mountain spotted fever has necessarily been somewhat brief, but sufficient however, to indicate that it is a complex problem. There is little chance that it can be solved except by an investigation planned on a broad basis and continued for a period of several years. Whatever the outcome of such an investigation may be, it will result it securing considerable data that will be of value wherever the application of control measures may be desirable.

EXPERIMENTAL STUDIES ON THE VIRUS OF ROCKY MOUNTAIN SPOTTED FEVER.

By
R. R. SPENCER, M. D.,
Surgeon in Charge, U. S. P. H. S.
Hamilton, Montana.

Among experimental studies of the Public Health Service, during the past year, upon the virus of Rocky Mountain spotted fever, there have been few observations which have proven of interest or of possible potential value. I shall, therefore, refer only to these seemingly significant experiments.

During a similar study of the virus, you may recall that Wilson and Chowning, in 1902, described an intracellular organism as the cause of Rock Mountain spotted fever. This observation has never been confirmed. But Wilson and Chowning were, nevertheless, the first to advance the tick theory of transmission, calling attention to the coincidence of the seasonal prevalence of the disease with the appearance of adult ticks in the spring of the year. Noting the excessive numbers of ground squirrels in the Bitter Root Valley, the opinion was also expressed that these rodents were the probable animal reservoir of the infection.

Following these workers, Ricketts in 1906, proved the tick theory of transmission by feeding upon guinea pigs adult ticks secured in the field. Ricketts further showed that each stage of the tick (egg, larvae, nymph and adult) was infective and that there was a stage to stage transmission of the virus.

Wolbach of Harvard University has described as the etiological agent three morphologically distinct forms of rickettsia-like bodies in the gut contents and the tissues of infected ticks. Similar bodies were described in the intima of blood vessels of both man and animals.

General Properties of the Virus

In regard to some of the better known properties of the virus, it may be mentioned that it is very sensitive to heat and chemical agents. In glycerine at room temperature, it dies within a few days. Its thermal death point lies between 45 degrees and 50 degrees C. Simple dessication will destroy it in from ten to twenty-four hours. So far as known, passage through a Berkfeld filter has never been successful. This may be explained by the fact that the described organisms are usually found within the cell cytoplasm and supposedly disintergrate rapidly when separated from the cell substance. As far as we have been able to determine, the virus in the tick is no more readily filterable than the tissue virus.

Survival of Virus in Tissues.

During the past winter the virus has been kept alive and infectious for a period of three months in tissues of animals. It was known, of course, that it survived in the tick over considerable periods of time and consequently, there was no apparent reason why it should not live in animal tissues under suitable conditions. After many failures it was found to live when it was quickly dessicated in vacuo and kept constantly at a temperature below 12 degrees F. The virus also survived in glycerine for three months when kept at the same low temperature. Infectiousness at the end of this time was ascertained by animal inoculation—the guinea pigs showing typical lesions of spotted fever and the strain being carried on for several generations. In order to rule out other infections causing fever, heart's blood cultures were taken and were uniformly negative. From these observations, it was tentatively concluded that dehydration and extreme cold were the essential criteria of viability.

Longevity of Virus in Ticks.

The life history of the tick makes it certain that the virus lives through the severest winters in the tick tissues.

Recent laboratory tests upon ticks that were infected last summer have confirmed this but, as yet, our tests have not extended far enough to state that the virus will live more than one season in unfed ticks.

Virus in Tick Eggs

Although experiments are not yet completed, our experiences with the virus in tick eggs has shown, as compared with that in adult ticks, that it rather quickly loses its virulence and passes through an immunity-producing phase before death. The concentration of the virus in the tick eggs must necessarily be high, since a single egg is sufficient to infect a guinea pig. The average tick egg by careful test, weighs only .06 milligram or .00006 gram.

Virus in Fasting and Recently Fed Ticks

Early last spring certain experiments were conducted which, while not necessarily indicating a definite cycle, have nevertheless added somewhat to our knowledge of the virus as it occurs in ticks. I refer to the striking difference in infectivity of the virus in fed, as compared with fasting ticks.

This fact was disclosed in the following way: Our plan had included the determination of the percentage of infected ticks in nature. Since it was believed that the usual method of feeding ticks on guinea pigs was not dependable, a preliminary experiment was carried out to compare the results of feeding with the inoculation of macerated tick contents, our criterion of infectivity being either the development of spotted fever or the development of an immunity to spotted fever. The outline of this experiment was as follows:

March 16th to 20th: Twenty-five ticks were fed on infected guinea pig No. 420.

March 22nd: Twelve of these ticks were selected for testing; six were permitted to feed on a guinea pig each for three days; the remaining six were dissected and the eviscerated tick contents of each, emulsified in salt solution and inoculated into each of six pigs.

Results of tick content inoculations: Four of the six pigs inoculated with the contents of infected ticks developed spotted fever, and two were rendered immune.

Results of tick feeding: None of the six pigs upon

which infected ticks were fed developed spotted fever—one died of pneumonia. After an afebrile period of ten days, the five remaining pigs each received intraperitoneally the contents of the tick which had previously fed upon it. Three of the pigs developed spotted fever as a result of this inoculation; the other two died of an intercurrent infection.

From this experiment it was thought reasonable to conclude that the inoculation of tick contents was the more reliable method, and consequently all ticks secured were routinely inoculated into guinea pigs in groups of 15 to 25. Over 100 lots of such drag ticks were thus inoculated without once producing spotted fever, although many of these tick lots were collected in well-known infected areas. When immunity tests were given, some of these pigs were found to be immune.

In three similar tests of tick lots from a mountain goat, spotted fever promptly developed.

The essential difference between the drag ticks and the goat ticks was that the latter had recently ingested blood, whereas the former had not fed since engorging as nymphs not later than during the season of 1921. These results suggested that fresh blood was necessary to reactivate the virus.

Our procedure was then changed so that ticks to be tested were first fed on guinea pigs for 48 hours and if no fever developed within ten days following the removal of ticks, the contents of the same tick were then inoculated into the pig upon which they fed; if fever did not develop in another ten days, the pig was given the immunity test.

In testing unfed adults by this combination feeding-inoculation method, the fever may develop after feeding, after the inoculation, or the pig may be rendered immune.

We have also been able to show that the virus may be reactivated by incubating the tick either at 37 degrees C. for 7 to 24 hours, or at room temperature from two to ten days. Incubation of infected tick contents with defibrinated guinea pig blood has been unsuccessful, perhaps because of the overgrowth of extraneous organisms from the tick. The inoculated guinea pigs usually died of peritonitis.

Since the virus has been revived by incubation it was

reasonable to suppose that the causative organism could be more readily demonstrated in suspected ticks just after they have been incubated. So far as we have gone with a small series of ticks, this has proven the case.

When smears were made of, and animals inoculated from the same tick tissues, the organisms have been demonstrated invariably in those ticks the contents of which produced spotted fever upon inoculation. On the other hand, the smears from known non-infected ticks have been uniformly negative.

PROPHYLACTIC INOCULATION AGAINST ROCKY MOUNTAIN SPOTTED FEVER

By

HIDEYO NOGUCHI, M. D.

(From the Laboratories of the Rockefeller Institute for Medical Research, New York.)

Attempts to develop a method of protecting non-immune human beings from spotted fever were made by Ricketts in 1907, but his work remained unfinished, and no prophylatic procedure applicable to man has so far been devised. Ricketts followed the line of thought then current, and still applicable in the majority of instances, that in order to secure effective immunity by a mixture of immune serum and virus the serum must be used in slightly under-neutral proportions; immunity developing as the result of a mild but genuine infection. Such a procedure, although effective in experimental animals such as guinea pigs, is not of practical value, since it cannot be used in the case of human beings.

For several years I have been interested in the study of the spotted fever virus, more recently with respect especially to the development of a practical method of vaccination, for which there seemed to be urgent need. With several strains of the virus, obtained from Montana through the kind cooperation of Dr. R. R. Parker, I have conducted at the Rockefeller Institute a systematic study of the phenomena of immunity in spotted fever, the results of which form the substance of my report today.

The various procedures which have been successfully

applied in the preparation of certain bacterial vaccines, such as heating, or killing with chemicals, were found to deprive the virus of spotted fever of its immunizing power. A sero-vaccine containing immune rabbit serum in amounts slightly below that necessary for neutralization of the virus gave durable and complete immunity. The inquiry was pushed a step further to determine whether or not the addition of the immune serum in an amount sufficient to neutralize the virus, or even in many times the neutralizing quantity, would diminish or nullify the immunizing properties of the sero-vaccine. Contrary to expectations, the results of actual experiment on guinea pigs showed that a neutral or superneutral mixture of immune serum and spotted fever virus (in the form of a guinea pig passage strain) gives rise to just as strong immunity as the underneutralized mixture without, however, inducing any perceptible signs of infection. The degree of immunity induced by the neutral or superneutral sero-vaccine is such that the vaccinated guinea pigs resisted infection 1 to 13 months after the time of vaccination, even when the amount of virus injected represented many times the minimum lethal dose (in some instances the animals were given as many as 10,000 minimum lethal doses).

With regard to the possibility of applying this procedure directly to human beings, the question arose as to whether or not a mixture of virus and immune serum which is neutral or superneutral for a guinea pig of 500 grams will still be neutral when injected into an animal weighing two hundred times as much. No animals of the size of man are known to be susceptible to spotted fever, hence no direct determination of the point could be made. The question was determined indirectly, however, as follows:

Neutral and superneutral mixtures of virus and immune rabbit serum as adjusted for guinea pigs, were prepared in such a way as to contain respectively 100m. l. d. of virus (1 cc.) with an amount of immune serum just sufficient for neutralization (0.1 cc.), and the same amount of virus with ten times the neutral amount of immune serum (1 cc.). 2 cc. of the undiluted mixtures, and the same amount of 1:10, 1:100, and 1:1,000 dilutions respectively, were inoculated into a series of guinea pigs.

The animals which received 2 cc. of the undiluted neutral mixture showed no reaction whatever; those which received 2 cc. of the 1:10 dilution (10 m. l. d. of virus +0.01 cc. of serum) had definite febrile reactions; 2 cc. of the 1:1,00 dilution (1 m. l. d. of virus + 0.001 cc. of serum) produced a typical fatal infection, and 2 cc. of the 1:1,000 dilution (1-10 m. l. d. + 0.0001 cc. serum) no infection. On the other hand, in the case of the superneutral mixtures dilution had no effect upon the neutralizing power of the serum until the 1:100 dilution was reached (1 m. l. d. of virus + 0.001 cc. of serum); 2 cc. of this dilution induced a definite but non-fatal infection.

From these experimental data it may be inferred that the neutralization of the virus by the immune serum is not analogous to that of a base by an acid, but is affected by the degree of dilution which the serum undergoes when injected into the body of the animal; when diluted beyond a certain point it no longer exerts a neutralizing effect upon the virus. For example, 0.1 cc. of the immune serum in a guinea pig of 500 grams weight neutralized 100 m. l. d. of the virus, 0.01 cc. only partially neutralized 10 m. l. d., and 0.001 cc. failed to neutralize 1 m. l. d. If the neutralization were a direct one, the whole mixture would have remained neutral no matter what fraction of it was injected, but analysis of the experiment shows that the proportion of immune serum to the weight of the animal is intimately related to the neutralization. The amount of serum must be at least 0.1 cc. per 500 grams of body weight in order to destroy the virus completely *in vivo;* 0.01 cc. only partly destroyed it, and 0.001 had but slight effect even against 1 m. l. d. For an animal with susceptibility equal to that of a guinea pig the minimum requirement of immune serum may be calculated by multiplying 0.1 cc. by the number of grams body weight divided by 500. The minimum requirement for a man weighing 100 kilograms (223 lbs.) would be 20 cc. (0.1 cc. times 100,000 five hundredths) a quantity altogether too large for practical vaccination in man. In order to reduce the volume of the neutral or superneutral mixture for human vaccination it would be necessary to prepare a far more potent immune serum than is available at present, one at least 10 to 15 times as strong. Work along this line is in progress.

In the meantime, experiments have been carried out to ascertain whether or not heating of the neutral or super-neutral mixtures to 56° to 60° C. for 10 to 20 minutes in a water bath will destroy the immunity-producing property of the mixture. Heating kills the virus of spotted fever, and it was already known that a killed virus or one which has spontaneously died out on standing never produces immunity to the active virus. The question to be determined was whether a virus killed in the presence of immune serum differs in immunizing property from that killed alone. Experiments with guinea pigs showed that it is different; inasmuch as heated neutral mixtures confer immunity upon guinea pigs while killed virus does not. The degree of protection produced with the heated mixture was somewhat inferior to that produced with the unheated portion of the same material, but notwithstanding this slight difference I have concluded that it is desirable to test the efficacy of the heated neutral mixture for human vaccination. There is reason to believe that the human body requires but little initial immunity in order to resist infection by the bites of infected ticks, which probably never introduce more than a minimum infecting dose of the virus. Whether or not the vaccination has protective value will become evident in the natural course of events by application to persons who are exposed to natural infection. Absence of spotted fever among vaccinated persons, or a marked decrease in the proportion of cases, notwithstanding continued high incidence among the non-vaccinated, would constitute evidence of the protective effect of the procedure.

TICK PARALYSIS

By

W. F. COGSWELL, M. D.

Secretary, Montana State Board of Health.

Tick paralysis, so called, is an acute ascending paralysis following the bite of an infected tick and recoverable if the tick is removed early enough. Tick paralysis was first noticed in animals and is common among domesticated animals along the eastern coast of Australia, in British

Columbia and in the western Rocky Mountain states. It has been noticed that the younger the animal the less favorable the prognosis.

In human beings most of the cases reported have been among children under ten years of age. McCornack[1] collected thirteen cases of which twelve were in children.

Cases reported to the Montana State Board of Health, all in children, are as follows:

1918	2
1919	1
1920	2
1921	1
1922	0

There is no question but what many cases have occurred unrecognized and some have probably been confused with anterior poliomyelitis.

Diagnosis.

An acute ascending paralysis occurring in a child previously well, with no history of exposure to contagion, and in a tick-infested country should arouse suspicion. Definite diagnosis is of course made by the finding of the tick on the body.

Course of the Disease.

The onset is rapid and characterized by acute ascending motor paralysis which may involve the muscles of respiration and of deglutition; general malaise and lassitude precede the paralysis for a few hours and are followed by diminution of motor power in the extremities. In the last stages diarrhea and vomiting may occur and fever may reach 104°. The general picture is that of an acute intoxication accompanied by a rapid ascending paralysis. If the tick is not found and removed early, paralysis of the muscles of deglutition may occur followed by paralysis of the muscles of respiration and death. If the tick is removed before the involvement of the respiratory apparatus, recovery usually occurs rapidly.

In this country the offending tick is the *Dermacentor venustus,* while in Australia, Dodd[2] found the paralysis caused by the *Ixodes ricinous* or the *Ixodes holocyclus.*

(1) Paralysis in children due to the bite of a wood

tick by P. D. McCornack, M. D., Spokane, Washington, Journal American Medical Association, July 23, 1921.

([2]) Tick Paralysis, by Sidney Dodd, D. V. S. F. R. C. V. S., University of Sidney from the Agricultural Gazette of New South Wales.

RESOLUTIONS PASSED BY THE CONFERENCE.

Whereas, there has existed for many years in the states of Montana, Idaho, Wyoming, Oregon, Washington and bordering states in the northwest, a serious tick borne disease with an unusually high mortality, and

Whereas, there is evidence that the disease is slowly spreading in these states, and

Whereas, the United States Public Health Service through Surgeon General Hugh S. Cumming, has recognized the serious nature of this disease by establishing a field laboratory at Hamilton, Montana, for the purpose of investigating the Rocky Mountain spotted fever and determining methods of preventing and controlling the same, and

Whereas, the trained investigators at the risk of their own lives are making definite progress in the solution of this difficult problem, and

Whereas, the Rockefeller Institute for Medical Research is collaborating with the United States Public Health laboratory at Hamilton, Montana, and is perfecting a prophylactic serum for the protection of human beings,

Therefore, Be It Resolved; That this conference of health authorities of the northwest states do hereby express their approval of the excellent work being done by the United States Public Health Service and the Rockefeller Institute and unanimously petition that their work be continued and extended until a definite means are provided for controlling and preventing this growing menace to life.

Dr. Frederick D. Stricker,
Dr. Albert B. Tonkin,
Prof. R. A. Cooley.